EPA United States Environmental Protection Agency
Inside the Greenhouse
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Making a Sink, Not a Stink

You've heard for years that sending yard trimmings to your community's centralized composting facility is good for the environment. But did you know that it also can help reduce greenhouse gas emissions?

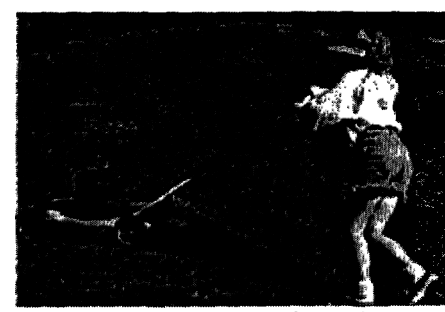
Compost, the practice of creating complex organic substances from organic residues through a process of biological decomposition, has long been recognized as an excellent way to increase soil organic matter. This is especially true for degraded soils that contain less carbon than they did when they were covered with native vegetation.

"In addition to compost's traditional role in producing abundant crops and beautiful flowers," says George Garland, of EPA's Office of Solid Waste, "compost has shown a remarkable ability to remediate contaminated soils, improve disease and pest resistance, reduce erosion, and increase moisture retention. And it even appears to help sequester carbon in soils."

Until recently, the climate-related benefits of compost had not been analyzed thoroughly. In 1999, the Climate and Waste Program in EPA's Office of Solid Waste launched a study aimed at understanding and quantifying the greenhouse gas implications of composting versus other waste management practices.

Yard trimmings, including grass, leaves, and branches, were chosen as the focus of the analysis due to the availability of data and the prevalence of yard trimmings in the municipal solid waste stream. In 1997, nearly 28 million tons of yard trimmings were generated in the United States, representing about 13 percent of municipal solid waste.

At the start of the analysis, EPA identified all of the possible sources of greenhouse gas emissions and sinks associated with composting yard trimmings. Possible emissions include carbon dioxide emissions during the collection and transport of yard trimmings to a central composting facility, methane emissions from decomposition in the absence of oxygen during the composting process, and carbon dioxide emissions from decomposition once the compost is added to the soil. On the other side of the equation, EPA analyzed the potential for compost to produce a carbon sink—long-term storage in the soil.



If composted properly, yard trimmings can be turned onto a net greenhouse gas sink

Through literature searches, interviews with compost experts, and modeling runs, EPA analyzed each source. First, the agency found that composting, when

managed properly, does not generate methane emissions. Properly managed compost is aerated and turned to ensure aerobic decomposition (i.e., decomposition in the presence of oxygen). As long as the yard trimmings decompose aerobically, methane is not generated. Researchers noted that even if methane is generated in anaerobic pockets (i.e., oxygen-devoid pockets) in the center of the compost pile, the methane is most likely oxidized when it reaches the oxygen-rich surface of the pile.

EPA also noted that carbon dioxide emissions during decomposition "do not count" towards national inventories of greenhouse gas emissions submitted annually to the United Nations Framework Convention on Climate Change. According to internationally accepted rules, these emissions are considered part of the natural carbon cycle and are not a reflection of human activities.

On the other hand, EPA found that composting does result in minimal carbon dioxide emissions during the collection and transport of yard trimmings to the composting facility. Emissions from transport and collection of compost are likely to vary widely, depending on the degree of urbanization. The estimates used in EPA's analysis assumed a distance of 20 miles from the point of collection to the centralized composting facility.

Using CENTURY, a Fortran model of plant-soil ecosystems that can track changes in carbon levels due to the addition of compost, EPA found that compost leads to long-term carbon storage in degraded soils. Compost from yard trimmings applied at various rates to depleted agricultural soil for 10 years was able to restore some of the carbon lost during cultivation.

All told, for all of the compost application rates, the benefits of long-term carbon storage outweigh the carbon dioxide emissions during transport.

In order to verify the results of this analysis, EPA initiated a review process with experts who specialize in modeling, soil science, and compost applications. Once the review is complete, EPA will publish the final results in a revised version of a report titled *Greenhouse Gas Emissions from Management of Selected Materials in Municipal Solid Waste.* The revised report is expected to be released in the fall of 2000.

Garland notes when yard trimmings are landfilled, they contribute to the generation of landfill methane, the third largest major source of greenhouse gas emissions in the United States. (This ranking assumes that all fossil fuel combustion is lumped together and not broken out by subsector, like transportation.) Managing yard trimmings through composting avoids methane generation as well as providing carbon sequestration benefits. For these reasons, Garland says, "Compost is expected to be an important contributor to future climate mitigation strategies." He notes that EPA is also looking at the role that compost can play in "eliminating methane emissions from landfills through adding a compost layer that oxidizes the methane."

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